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Observation of the Catfish *Chaetostoma microps* Climbing in a Cave in Tena, Ecuador

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Abstract

As part of a mapping and preliminary flora and fauna inventory of hypogean life in caves, developed in Cretaceous limestones in the sub-andean zone of Ecuador, we were able to observe a number of catfish climbing a steep flowstone waterfall in the dark zone of a cave. The waterfall was a minor infeeder to the small stream that flowed through the cave. On investigation the fish were determined to be *Chaetostoma microps* Günther, 1864 (Siluriformes Loricariidae), a detritivorous–herbivorous neotropical freshwater catfish, endemic to the upper reaches of the Amazon basin in Ecuador. We document the observation of this species exhibiting climbing behavior as well as the first observation of the family exhibiting climbing behavior in a cave. We also document the sympatry of this species and *Astroblepus pholeter* Collette, 1962 (Siluriformes Astroblepidae).

Keywords

Catfish, Karstic caves, Ecuador

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Observations

Mapping and documenting caves was conducted in the vicinity of Tena, Napo District, Ecuador. Our team visited a number of caves, of which several had sufficient inflow through subterranean infeeders to maintain small amounts of stream flow, with occasional larger pools of standing or slowly flowing water. A number of scattered individual fish of three distinct types were observed. Two small (3–8 cm) catfish were seen, one with little to no obvious pigment and very reduced eyes, and another of similar size, but pigmented and with normal eyes. In two larger pools we also had very brief observations of a generally fusiform, highly reflective fish estimated to be from 5–10 cm in size. These last observations were very brief and insufficient for any attempt at identification. As we had no permit and were not equipped for collection, we did not capture any fish from the streams or pools. The unpigmented catfish were taken out of the water and we were able to make close observation as well as to take some photographs of them. Based on the general appearance we determine them to be *Astroblepus pholeter* Collette, 1962. The pigmented catfish were more skittish, and we were unable to make any close observations. In a later cave however, we were quite surprised to find them in a context that allowed for more detailed observation, climbing out of the stream in a relatively small amount of flowing water originating higher in the cave wall.

The fish were observed climbing a flowstone waterfall originating in an area of two to three irregularly shaped openings on the east side of the main passage about 3 meters above the stream level in the main passage. These openings are of approximately 40 cm wide and 10 cm high with water flowing through the lower third or less, flowing from a small pool 5–10 cm deep that cannot be accessed or observed for more than one meter. Total flow was estimated to be in the range of 5–15 liters per second, which spread primarily in sheet flow of 0.5–1.5 cm thick down a flowstone formation about 1.5 meters, to a ledge with small pools with a total area of about 1 square meter. This continued down a the lower, larger portion of flowstone in sheet flow, continuing for approximately another 1.5 meters to stream level. Slope on the flowstone sections ranged from slightly overhung to horizontal, with a least sloping path requiring significant sections of 70–80 degree slope to be traversed, and the more direct path having near vertical sections (Fig. 1).

Two individuals were observed on the lower part, above a near vertical section of the flowstone about 1 meter above the stream, and three individuals were on the upper part within 10–30 cm from the inflow source on a near vertical section. One of the individuals on the lower section quickly spooked and dropped off the wall into the water below. Photographs and video were acquired of the second lower individual, which reacted to our presence and made a number of movements across the flowstone, primarily horizontal with some loss of elevation (Fig. 2). A video of the movement of the fish across the flowstone may be seen at http://www.youtube.com/watch?v=YyzPZfCbC-s. We attempted to capture this individual for identification, but lacking nets the attempt by hand was unsuccessful. Subsequently one of the individuals near the top of the flowstone was captured using a glove. It was photographed (Fig. 3) and released alive and in good condition in the pool.

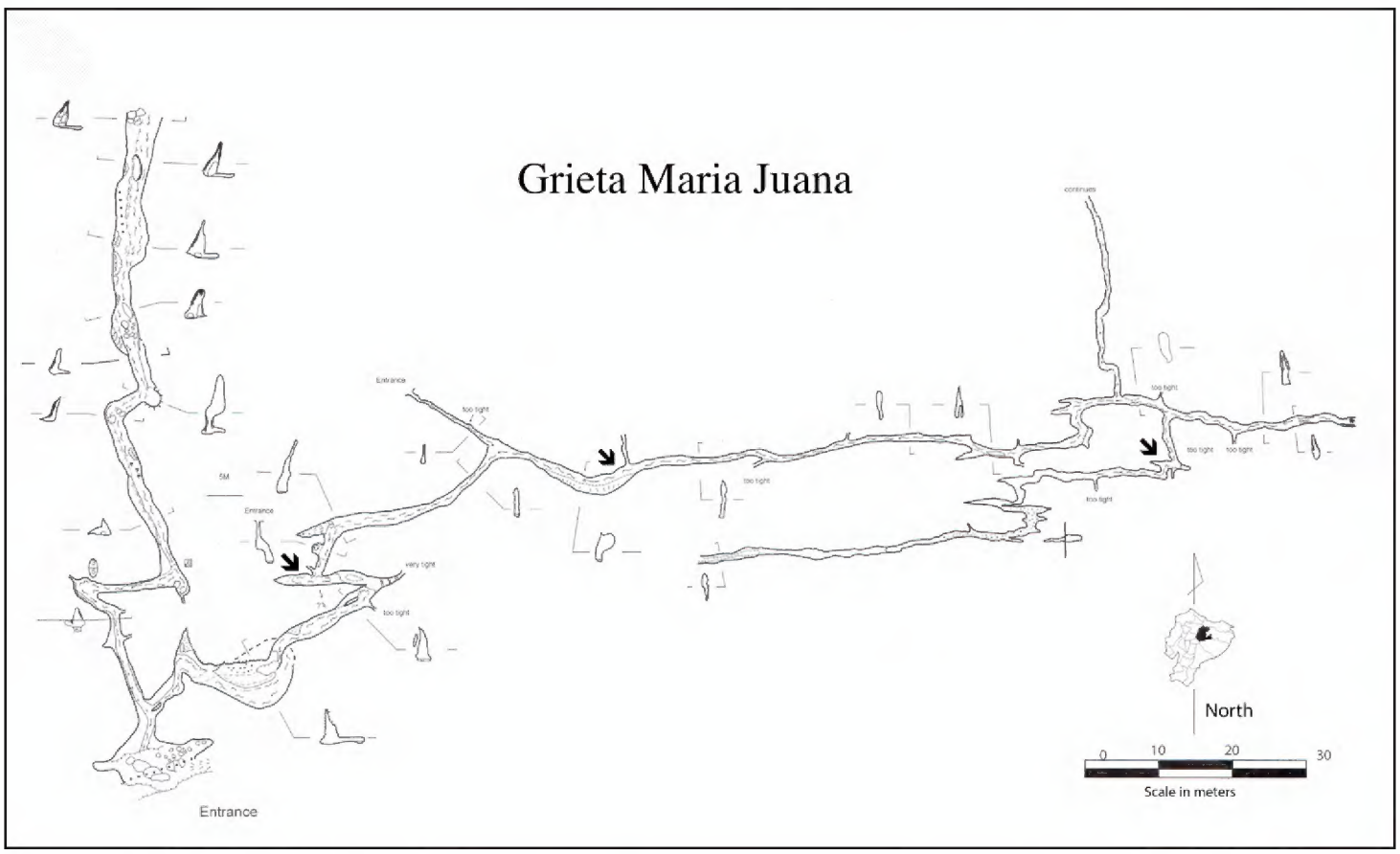

Figure 1. Map of Cave showing location of observation (arrows) of the catfish. Location of cave is some 8.3 km east of Tena city, close to the community Guayusa Loma.

Discussion

Loricariids and other fish have been known to climb rocks and waterfalls on surface streams and significant research has been undertaken on this behavior (Schoenfuss 2003, Blob and Rivera 2008, Blob et al. 2010). Climbing behavior is known from epigean astroblepids and loricariids (Schaefer 2003, Schaefer and Provenzano 2008) Although this observation is of a single location in one cave, it seems a reasonable extrapolation that it is not an unusual event for the species of these taxa to climb both in surface streams and in other caves.

Studies have been done of the anatomical characters loricariids use to climb (Geerinckx et al. 2007) as well as respiratory adaptations that may allow them access in the high levels of carbon dioxide and low oxygen that may be present in cave waters (Brauner et al. 1995, Armbruster 1998, MacCormack et al. 2003, Proudlove 2006). Although these studies provide a basis for speculation, the actual motivation for a given catfish to climb in the cave may be harder to assess. The inflow observed was unlikely to have originated from a surface stream. It seems reasonable to assume that it originates from percolating meteoric water, accumulating in a series of larger voids until sufficient flow is established to maintain a continuous stream. The interest of the catfish in reaching the headwaters of this flow is unclear. The more obvious possibility would be that they merely occupy the physical limits of the range they are capable of reaching, and that the extension of this into caves is coincidental. This suggestion can be extended to include otherwise unrelated behavior, such as spawning, that may provide additional impetus to head upstream. As *Chaetostoma* have been shown to be

Figure 2. *Chaetostoma microps* in situ on flowstone wall in sheet flow. Note that the fish is facing up. The slope at this location is estimated to be approximately 75 degrees.

more algivorous (Lujan et al. 2012) it seems unlikely that they inhabit the caves for extensive periods. However, flowstone features and rocks in cave streams may host microbial films that could be grazed, providing some nutrition.

We would be remiss not to consider that unrecognized benefits may have provided selection pressure as an agent in the adaption of caves into their range. There are a

Figure 3. *Chaetostoma microps,* lateral view.

number of possible suggestions, all of which are speculative. In the case of spawning, cave adapted *Astyanax mexicana* has been shown to be sensitive to water temperature induced spawning (Borowski 2008). However, other climbing fishes are known to spawn in the ocean and return to fresh water streams as adults (Fukui 1979, Kinzie 1988). Greater dispersal to small pools in the upper reaches of cave systems may increase survivability in drought conditions. Predators may also be avoided by this behavior, as has been suggested for other taxa (Blob et al. 2010). It does seem reasonable to assume that a fair number of the infeeders of the broader river basin where this species is resident have their origins in springs that flow from a number of caves. A correlation of this range to the extent of the geologic range of the karstic members in the area may provide some insight, although insufficient data exists at present to make any determinations. In any event, it is clear that further study is needed to understand this behavior.

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